US007813643B2

(12) **United States Patent**
Chen

(10) **Patent No.: US 7,813,643 B2**
(45) **Date of Patent: Oct. 12, 2010**

(54) **PORTABLE ELECTRONIC APPARATUS HAVING REMOTE CONTROL MODULE**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 552 days.

(21) Appl. No.: **11/849,118**

(22) Filed: **Aug. 31, 2007**

(65) **Prior Publication Data**

US 2008/0131131 A1 Jun. 5, 2008

(30) **Foreign Application Priority Data**

Dec. 1, 2006 (CN) 2006 1 0157218

(51) **Int. Cl.**
H04B 10/22 (2006.01)

(52) **U.S. Cl.** **398/106**; 399/212

(58) **Field of Classification Search** 398/106, 398/212

See application file for complete search history.

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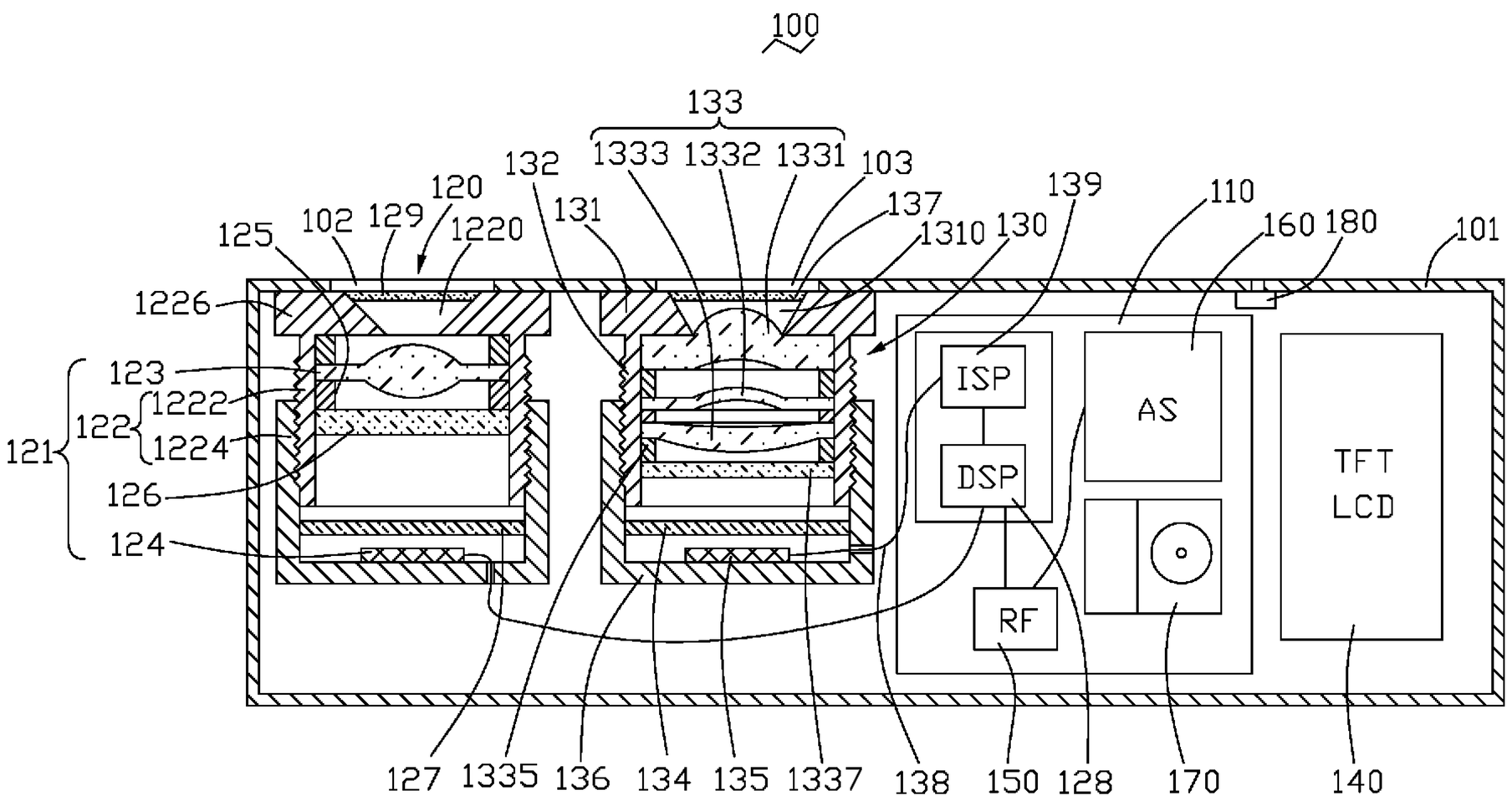
(57) **ABSTRACT**

An exemplary portable electronic apparatus having a remote control module is provided. The portable electronic apparatus includes a housing, a mobile communication module disposed in the housing, a remote control module disposed in the housing, and a radio frequency (RF) module electrically connected with the mobile communication module. The remote control module includes an infrared sensing module and a digital signal processing (DSP) module electrically connected with the infrared sensing module and the RF module. The RF module is configured for receiving external RF signals and transmitting information received from said mobile communication module and said DSP module with RF signals. The portable electronic apparatus can be used for infrared remote control and mobile communication.

18 Claims, 1 Drawing Sheet



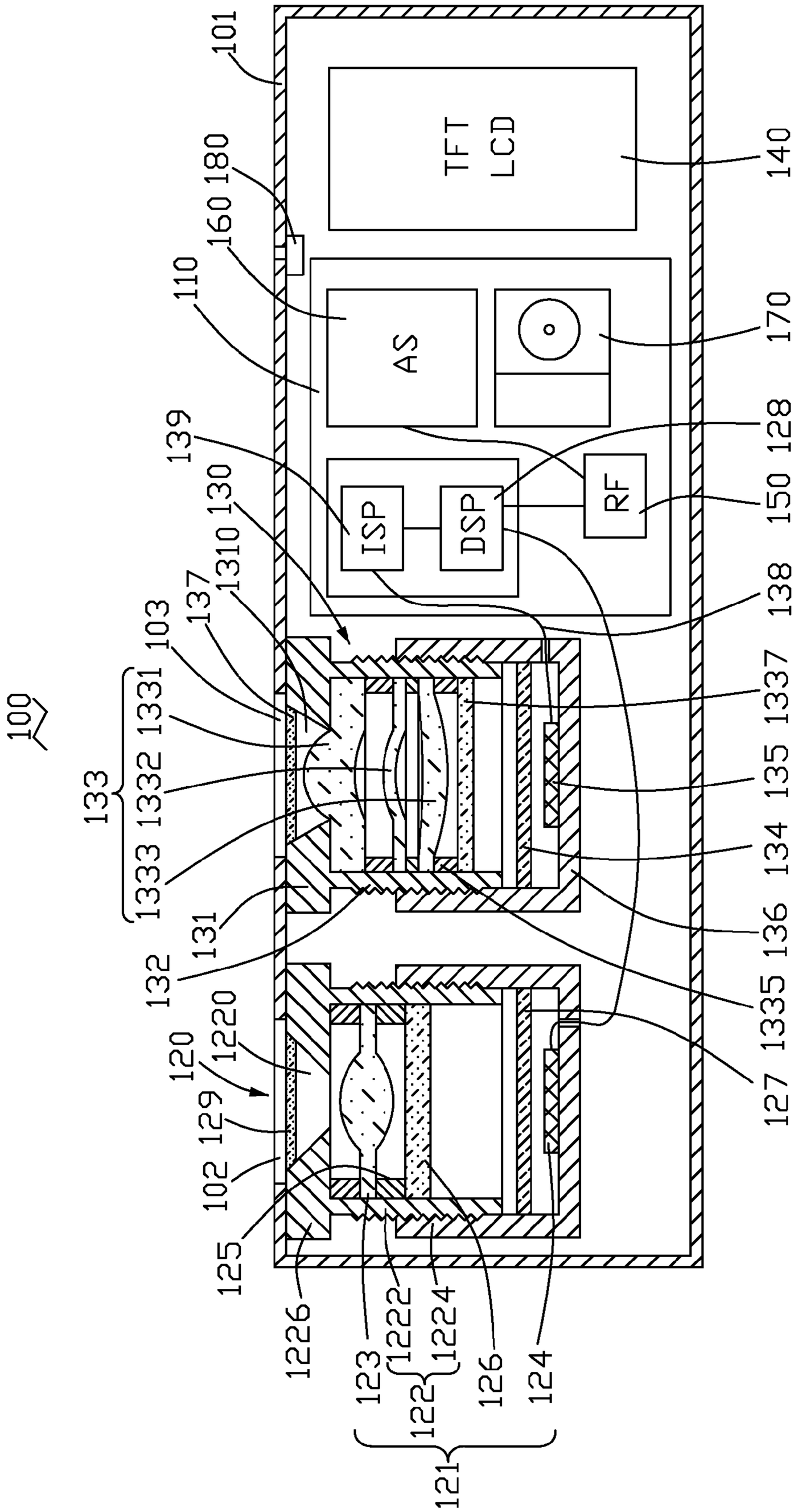

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FIG. 1

PORTABLE ELECTRONIC APPARATUS HAVING REMOTE CONTROL MODULE

BACKGROUND

1. Technical Field

The present invention relates generally to the field of electronic products, and more particularly, to a remote control module and a portable electronic apparatus having the same.

2. Description of the Related Art

Electronic gaming has been popular in recent years. In a typical electronic gaming machine, a remote control module is connected to a main unit of the electronic gaming machine by a cable. The remote control module generally includes a control panel with several buttons and joysticks thereon. When playing a game, a user presses the buttons or moves the joysticks to remotely control the main unit of the electronic gaming machine. However, after frequent use of the buttons and the joysticks, the mechanical parts therein tend to get worn out, thus degrading the precision of the remote control and the gaming experience of the user.

On the other hand, cell phones have been widely used by consumers for many years. A typical cell phone generally includes a keypad. A user presses buttons on the keypad to dial a phone number. However, in some emergency situations, it is not convenient or even possible to press the buttons.

Therefore, what is needed is to provide a remote control module and a portable electronic apparatus having the same which can reliably achieve precise remote control and dialing phone numbers without using a keypad.

SUMMARY

A remote control module, in accordance with a preferred embodiment, is provided. The remote control module includes an infrared sensing module and a digital signal processing (DSP) module electrically connected with the infrared sensing module. The infrared sensing module includes a barrel having a light entrance opening, an infrared sensor disposed in the barrel, and at least one optical element disposed between the light entrance opening and the infrared sensor. The at least one optical element includes at least one infrared pass filter. The DSP module is configured (i.e., structured and arranged) for processing signals received from the infrared sensor and transmitting signals corresponding to the result of such processing.

A portable electronic apparatus, in accordance with another preferred embodiment, is provided. The portable electronic apparatus includes a housing, a mobile communication module disposed in the housing, a remote control module disposed in the housing, and a radio frequency (RF) module electrically connected with the mobile communication module. The remote control module includes an infrared sensing module and a digital signal processing (DSP) module electrically connected with the infrared sensing module and to the RF module. The infrared sensing module includes a barrel having a light entrance opening, an infrared sensor disposed in the barrel, and at least one optical element disposed between the light entrance opening and the infrared sensor. The at least one optical element includes at least one infrared pass filter. The DSP module is configured (i.e., structured or arranged) for processing signals received from said infrared sensor and transmitting signals corresponding to the result of said processing to the RF module. The RF module is configured for receiving external RF signals and transmitting information received from said mobile communication module and said DSP module in RF signals.

BRIEF DESCRIPTION OF THE DRAWING

Many aspects of the present remote control module and portable electronic apparatus can be better understood with reference to the following drawing. The components in the drawing are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present remote control module and portable electronic apparatus.

FIG. **1** is a block functional diagram of a portable electronic apparatus in accordance with a preferred embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENT

Referring to FIG. **1**, a portable electronic apparatus **100** having a remote control module, in accordance with a preferred embodiment, is provided. The portable electronic apparatus **100** includes a housing **101**, a mobile communication module **110**, a remote control module **120**, a camera module **130**, a display module **140**, a RF module **150** electrically connected with the mobile communication module **110**, and a multi-axial acceleration sensor **160** integrated with the mobile communication module. The mobile communication module **110**, the remote control module **120**, the camera module **130**, the display module **140**, the RF module **150** and the multi-axial acceleration sensor **160** are all disposed in the housing **101**.

An infrared window **102** and a camera window **103** are defined on the housing **101**, respectively corresponding to the remote control module **120** and the camera module **130**. The infrared window **102** and the camera window **103** can be defined in a same side of the housing **101** (as shown in FIG. **1**), or alternatively, can be defined on opposing or neighboring sides of the housing **101**, depending on the allocation of the control module **120** and the camera module **130**. A display window (not shown) is defined in the housing **101** at a location facing toward the display module **140**. Preferably, the housing **101** is made of elastic materials such as synthetic rubber, acrylonitrile butadiene styrene (ABS) or other synthetic materials. When the portable electronic apparatus **100** experiences a large impulse, these elastic materials will reduce the impact upon the portable electronic apparatus **100** and protect it from damage.

The mobile communication module **110** is fixed inside the housing **101**, on which signal processing circuits are configured for processing the signals that the mobile communication module **110** receives. The RF module **150** is integrated with the mobile communication module **110** for receiving and transmitting RF signals. Preferably, a blue tooth module is integrated in the RF module **150** for working with the RF module **150** to wirelessly receive and transmit signals.

The remote control module **120** includes an infrared sensing module **121** and a digital signal processing (DSP) module **128** electrically connected thereto. The infrared sensing module includes a barrel **122**, wherein an optical lens **123**, an infrared sensor **124**, and an infrared pass filter **126** are disposed.

The barrel **122** includes a barrel body **1222** and a barrel seating **1224** engaged therewith. A barrel lid **1226** is disposed on the top of the barrel body **1222** near the infrared window **102**. The barrel body **1222** is threadedly engaged with the barrel seating **1224**. The barrel lid **1226** is ring-shaped, and defines an essentially round-shaped light entrance opening **1220** confined therein for allowing infrared light to be received in the barrel **122**. Preferably, an infrared lens **129** is disposed in the light path of the light coming into the light

entrance opening **1220** for passing only infrared light and blocking light in other spectrums. The infrared lens **129** also serves to prevent dusts and dirt outside from getting into the barrel **122**. It is understood that the infrared lens **129** can alternatively be disposed in the infrared window **102**.

The infrared sensor **124** is disposed in the barrel seating **1224**, which can be a CMOS (complementary metal-oxide semiconductor) sensor or a CCD (charge coupled device) sensor configured for sensing light only in the infrared spectrum.

The infrared pass filter **126** is disposed inside the barrel **1222** between the infrared sensor **123** and the light entrance opening **1220**. The infrared pass filter **126** includes a transparent substrate and multiple layers of oxide film with different refractive indexes formed thereon, passing infrared light and blocking light in other spectrums. By preventing light in other spectrums from disturbing the infrared light reception on the infrared sensor **124**, the accuracy of infrared sensing is improved and so is the precision of the remote control. Preferably, the infrared pass filter **126** is formed by alternately depositing titanium oxide and silicon oxide films on the transparent substrate. The number of the layers is 30 to 50. It is understood that the multiple layers of films can be deposited directly on the optical lens **123** without using the transparent substrate.

The optical lens **123** is disposed between the infrared pass filter **126** and the light entrance opening **1220**. A spacer ring **125** is disposed between the infrared pass filter **126** and the optical lens **123**. Preferably, the optical lens **123** is a convex lens for focusing an image on the infrared sensor **124**. It is understood that the number of optical lens **123** is not limited to one. Multiple lenses can be configured to improve the accuracy of optical signal reception.

The DSP module **128** is configured for processing signals received from said infrared sensor **124** and transmitting signals corresponding to the result of said processing to the RF module **150**. Preferably, the DSP module **128** is integrated to the mobile communication module **110** and electrically connected with the RF module **150**.

Preferably, the remote control module **120** further includes a glass sheet **127**, disposed in the barrel seating **1224** between the barrel body **1222** and the infrared sensor **124** for protecting the infrared sensor **124**.

The camera module **130** includes a top lid **131**, a lens barrel **132**, a lens module **133**, a glass cover **134**, an image sensing element **135** and a lens seating **136**.

The top lid **131** is a ring-shaped cover board fixed on the top of the lens barrel **132**, defining an essentially round-shaped light entrance opening **1310**. The light entrance opening **1310** is aligned to the camera window **103** so that light coming into the camera window **103** is incident on the lens module **133** located inside the lens barrel **132**. Preferably, a protection lens **137** is disposed on the light entrance opening **1310**, or alternatively the camera window **103** for preventing dusts and dirt from contaminating the lens module **133**. It is understood that by properly positioning the protection lens **137**, the top lid **131** can be eliminated.

The lens barrel **132** is a hollow cylinder, a part of which is inserted into and threadedly engaged with the lens seating **136** in an adjustable fashion. A distance between the lens module **133** and the image sensing element **135** can be adjusted by adjusting the distance between the lens barrel **132** and the lens seating **136** for focusing purpose.

The lens module **133** disposed in the lens barrel **132** includes three lenses spaced from each other by spacers **1335**. The lens module **133** can be glued to the inner wall of the lens barrel **132** and the spacers **1335**. Preferably, an infrared cut filter **1337** is disposed in the lens barrel **132** on the light path, or alternatively an infrared cut coating is formed on any one of the lenses in the lens module **133**, for preventing the infrared light reflected by an object to be photographed from being incident on the image sensing element **135** and causing image noise.

The three lenses of the lens module **133** are respectively a first lens **1331**, a second lens **1332** and a third lens **1333**. These three lenses can be spherical or aspherical lenses. Preferably, the first lens **1331** is an aspherical convex lens, wherein an aspherical surface extends toward an object side of the first lens **1331**. The second lens **1332** is disposed behind the first lens **1331**, aspherical and in a similar shape as the first lens **1331**. The third lens **1333** is shaped symmetrically with the second lens **1332** for eliminating aberration and improving image quality. It is understood that the number of lens in the lens module **133** is not limited to three and can be chosen based on design consideration.

The glass cover **134** is fixed to the inner wall of the lens seating **136** and disposed between the lens barrel **132** and the image sensing element **135**. The glass cover **134** is configured for protecting the image sensing element **135**.

The image sensing element **135**, which can be a CMOS (complementary metal-oxide semiconductor) sensor or a CCD (charge coupled device) sensor, is disposed in the lens seating **136** and electrically connected to an image signal processing module **139** by a wire **138** for transmitting signals from the image sensing element **135** to the image signal processing module **139**. The image signal processing module **139** is integrated on the mobile communication module **110** for processing image signals and outputting the results to the display module **140**. Preferably, the image signal processing module **139** is electrically connected to the digital signal processing module **128** and can share some signal processing units therewith.

The display module **140** is electrically connected to the mobile communication module **110**, disposed in an end of the housing **100** and configured for displaying the information that the mobile communication module **110** outputs. Preferably, the display module **140** is a thin-film transistor liquid crystal display (TFT LCD) module.

The multi-axial acceleration sensor **160** is integrated to the mobile communication module **110** for sensing a three dimensional linear acceleration and a three dimensional angular acceleration of the portable electronic apparatus **100** and transmitting the corresponding information to the RF module **150**. The RF module **150** further transmits the information to a remote receiver. The multi-axial acceleration sensor **160** can be a six-axial acceleration sensor and manufactured by MEMS (Micro-Electro-Mechanical Systems) technology.

The portable electronic apparatus **100** can further include a micro hard disk drive **170** and an audio input device **180** such as a microphone. The micro hard disk drive **170** is disposed near the mobile communication module **110** for storing a variety of information. The audio input device **180** is disposed on a side of the housing **100** for recording audio information such as user commands.

In case that the portable electronic apparatus **100** is falling to ground or is going to collide with a hard object, the multi-axial acceleration sensor **160** can sense an abnormal acceleration and predict an impact. A signal will be sent to shut down the micro hard disk or other working objects in the portable electronic apparatus **100** before that impact happens. The portable electronic apparatus **100** is thus protected from damage.

The portable electronic device **100** is a multi-functional device. In one aspect, the portable electronic device **100** can be used as a remote control for an electronic gaming machine. Generally a main unit of an electronic gaming machine (not shown) includes an infrared light source such as an infrared light emitting diode array for emitting infrared light. The light emitted from the infrared light source is received and processed by the remote control module **120** and the result is sent back to the main unit of the electronic gaming machine by the RF module **150** to control the electronic gaming machine.

More specifically, an infrared optical signal transmitted from the infrared light source in the main unit of the electronic gaming machine is first filtered by the infrared lens **129** and then projected onto the optical lens **123** where the optical signal is focused and enhanced. The enhanced optical signal is further filtered by the infrared pass filter **126** and sensed by the infrared sensor **124**. The infrared sensor **124** converts the optical signal incident thereon to an electric signal and sends the electric signal to the DSP module **128**. When a user moves the portable electronic apparatus **100** in three dimensional space relative to the main unit of the electronic gaming machine, the signal that the DSP module **128** receives varies according to the position of the portable electronic apparatus **100**. By processing this signal, the DSP module **128** identifies the motion that the portable electronic apparatus **100** is making and sends the corresponding information to the main unit of the electronic gaming machine through the RF module **150**. By this means, the user can use the portable electronic apparatus **100** to remotely control the electronic gaming machine.

In the above embodiment, the infrared pass filter **126** in the remote control module **120** transmits light only in the infrared spectrum, eliminating the interference from light not in the infrared spectrum and improving the precision of the remote control. In addition, there is no mechanical wearing of the remote control module **120** during its operation, which improves its reliability and prolongs its usage life. Furthermore, the optical lens **123** focuses an image on the infrared sensor **124**, which enhances the optical signal strength and thus further improves the precision of the remote control.

It is understood that the portable electronic apparatus **100** can also be used for remotely controlling other information processing systems such as a computer.

In another aspect, the portable electronic apparatus **100** can be used as a cell phone with which a user can dial a phone number without a keypad. For example, if a user draws an "S" in air with the portable electronic apparatus **100**, meaning SOS, the multi-axial acceleration sensor **160** senses this motion and notifies the RF module **150** to dial a corresponded emergency phone number for help. As another example, when the user draws a number such as "911" in air with the portable electronic apparatus **100**, the corresponded phone number 911 can be dialed. This feature provides convenience to the user especially in an emergency situation when it is not convenient or even possible to dial numbers using a keypad.

It is understood that the portable electronic apparatus **100** can be used in other applications such as a compass, a velocity meter, a step counter and so on.

It is believed that the present embodiments and their advantages will be understood from the foregoing description, and it will be apparent that various changes may be made thereto without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the examples hereinbefore described merely being preferred or exemplary embodiments of the present invention.

What is claimed is:

1. A portable electronic apparatus, comprising:

a housing;

a mobile communication module disposed in said housing;

a remote control module disposed in said housing, said remote control module comprising:

an infrared sensing module including a barrel having a light entrance opening, an infrared sensor and at least an optical element, said infrared sensor being received in said barrel and including at least an infrared pass filter, said at least an optical element being received in said barrel and disposed between said light entrance opening and said infrared sensor; and

a digital signal processing module electrically connected with said infrared sensor of said infrared sensing module, said digital signal processing module being configured for processing signals received from said infrared sensor and transmitting processed signals to a receiver of an object associated therewith;

a radio frequency module electrically connected with said mobile communication module and said digital signal processing module of said remote control module, said radio frequency module being configured for receiving external radio frequency signals and transmitting information received from said mobile communication module and said digital signal processing module with radio frequency signals; and

a multi-axial acceleration sensor integrated with said mobile communication module and configured for sensing a linear acceleration and an angular acceleration of said portable electronic apparatus when said portable electronic apparatus is moving.

2. The portable electronic apparatus of claim **1**, further comprising a camera module disposed in said housing, said camera module comprising a lens seating, a lens barrel partly inserted in and engaged with said lens seating, at least one optical lens disposed in said lens barrel, and an image sensing element disposed in said lens seating.

3. The portable electronic apparatus of claim **2**, wherein said camera module further comprises an infrared cut filter disposed between said at least one optical lens and said image sensing element.

4. The portable electronic apparatus of claim **1**, further comprising a micro hard disk drive for storage.

5. The portable electronic apparatus of claim **1**, wherein said barrel of said remote control module comprises a barrel body and a barrel seating connected therewith, said at least one optical element is disposed in said barrel body, and said infrared sensor is disposed in said barrel seating.

6. The portable electronic apparatus of claim **1**, wherein said at least one optical element in said remote control module comprises at least one optical lens.

7. The portable electronic apparatus of claim **1**, wherein said remote control module further comprises an infrared lens disposed in said light entrance opening or between said light entrance opening and said at least one optical element.

8. The portable electronic apparatus of claim **1**, wherein said infrared pass filter of said remote control module comprises multiple oxide thin films with different refractive indexes which selectively allow light only in the infrared spectrum to pass therethrough.

9. A portable electronic apparatus, comprising:

a mobile communication module;

an infrared sensing module including a barrel having a light entrance opening, an infrared sensor and at least an optical element, said infrared sensor being received in said barrel and including at least an infrared pass filter,

said at least an optical element being received in said barrel and disposed between said light entrance opening and said infrared sensor;

a digital signal processing module electrically connected with said infrared sensor of said infrared sensing module, said digital signal processing module being configured for processing signals received from said infrared sensor;

a radio frequency module electrically connected with said digital signal processing module, said radio frequency module being configured for receiving external radio frequency signals and transmitting information received from said digital signal processing module with radio frequency signals; and

a multi-axial acceleration sensor integrated with said mobile communication module and configured for sensing a linear acceleration and an angular acceleration of said portable electronic apparatus when said portable electronic apparatus is moving.

10. The portable electronic apparatus of claim **9**, further comprising a camera module, said camera module comprising a lens seating, a lens barrel partly inserted in and engaged with said lens seating, at least one optical lens disposed in said lens barrel, and an image sensing element disposed in said lens seating.

11. The portable electronic apparatus of claim **10**, wherein said camera module further comprises an infrared cut filter disposed between said at least one optical lens and said image sensing element.

12. The portable electronic apparatus of claim **9**, wherein said barrel of said remote control module comprises a barrel body and a barrel seating connected therewith, said at least one optical element is disposed in said barrel body, and said infrared sensor is disposed in said barrel seating.

13. The portable electronic apparatus of claim **9**, wherein said remote control module comprises an infrared lens disposed in said light entrance opening or between said light entrance opening and said at least one optical element.

14. A portable electronic apparatus, comprising:

a housing;

a mobile communication module disposed in said housing;

a remote control module disposed in said housing, said remote control module comprising:

an infrared sensing module including a barrel having a light entrance opening, an infrared sensor and at least an optical element, said infrared sensor being received in said barrel and including at least an infrared pass filter, said at least an optical element being received in said barrel and disposed between said light entrance opening and said infrared sensor; and

a digital signal processing module electrically connected with said infrared sensor of said infrared sensing module, said digital signal processing module being configured for processing signals received from said infrared sensor and transmitting processed signals to a receiver of an object associated therewith;

a radio frequency module electrically connected with said mobile communication module and said digital signal processing module of said remote control module, said radio frequency module being configured for receiving external radio frequency signals and transmitting information received from said mobile communication module and said digital signal processing module with radio frequency signals; and

a camera module disposed in said housing, said camera module comprising a lens seating, a lens barrel partly inserted in and engaged with said lens seating, at least one optical lens disposed in said lens barrel, and an image sensing element disposed in said lens seating.

15. The portable electronic apparatus of claim **14**, wherein said camera module further comprises an infrared cut filter disposed between said at least one optical lens and said image sensing element.

16. The portable electronic apparatus of claim **14**, wherein said barrel of said remote control module comprises a barrel body and a barrel seating connected therewith, said at least one optical element is disposed in said barrel body, and said infrared sensor is disposed in said barrel seating.

17. The portable electronic apparatus of claim **14**, wherein said remote control module further comprises an infrared lens disposed in said light entrance opening or between said light entrance opening and said at least one optical element.

18. The portable electronic apparatus of claim **14**, wherein said infrared pass filter of said remote control module comprises multiple oxide thin films with different refractive indexes which selectively allow light only in the infrared spectrum to pass therethrough.

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